REMARKS

The present application was filed on February 10, 2004 with claims 1 through 22. Claims 1 through 22 are presently pending in the above-identified patent application. Claims 1, 7, 13, and 18 are proposed to be amended herein.

In the Office Action, the Examiner rejected claims 1-22 under 35 U.S.C. §101 because the claimed invention is directed to non-statutory subject matter. Claims 1-4 and 13-16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Madsen et al. ("Optical Filter Architecture for Approximating Any 2x2 Unitary Matrix," Optics Letters, vol. 28, no. 17, April 1, 2003, pages 534-536) in view of MacFarlane et al. (United States Patent Number 6,687,461). Claims 5 and 17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Madsen et al, in view of MacFarlane et al as applied to claims 4 and 16 respectively above, and further in view of Applicant's Admitted Prior Art. Claims 7-10 and 18-21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Madsen et al, and in view of Eyal et al ("Design of Broad Band PMD Compensation Filters," IEEE Photonics Technology Letters, vol. 14, no. 8, August 2002, pages 1088-1090). Claims 11 and 22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Madsen et al. in view of Eyal et al. as applied to claims 7 and 18 respectively above, and further in view of Applicant's Admitted Prior Art. Claims 6 and 12 may contain allowable subject matter if rewritten in independent form including all of the limitations of the base claim and any intervening claims but are currently rejected under 35 U.S.C. 101 as discussed above.

Section 101 Rejection

Claims 1-22 are rejected under 35 U.S.C. 101 because the claimed invention is directed to non-statutory subject matter. In particular, the Examiner asserts that, reading claims 1-22 in light of the specification, the recited method or apparatus encompasses software (i.e., functional descriptive material), that does not fall within any of the statutory subject matter.

Applicant notes that the independent claims have been amended to require "wherein said adjusting step is performed by a device" and that, therefore, claims 1-22 fall within the statutory categories. Applicant respectfully requests that the section 101 rejections be withdrawn.

Section 103 Rejections

Independent claims 1 and 13 were rejected under 35 U.S.C. §103(a) as being unpatentable over Madsen in view of MacFarlane et al. With regards to claim 1, for example,

the Examiner asserts that Madsen discloses a method for compensating for polarization mode dispersion in an optical fiber communication system (citing Figures 1-3), comprising the steps of: reducing said polarization mode dispersion using a cascade of all-pass filters (citing Abstract and Fig. 3); and adjusting coefficients of said all-pass filters. (citing page 535, left column, first complete par.).

The Examiner acknowledges that Madsen adjusts the coefficients using a least square algorithm (citing page 535, left column, first complete par.), but does **not** disclose adjusting the coefficients using a *least mean square algorithm*. The Examiner asserts, however, that MacFarlane et al. teach a system related to Madsen including optical filters for compensating for polarization mode dispersion having adjusted coefficients (col. 1, lines 28-53, col. 2, lines 51-65 and col. 5, lines 23-42). The Examiner further asserts that MacFarlane et al. teach that the filter coefficients can be adjusted using a variety of minimization algorithms including a least squares algorithm or an LMS algorithm (col. 19, lines 16-22).

Applicant notes that independent claims 1 and 13 require adjusting coefficients of said <u>two-port</u> all-pass filters using a least mean square algorithm. Support for this amendment can be found, for example, in FIGS. 5 and 6 and associated text wherein the cross-coupled box T, as defined in equation (1), defines a two-port network since the two channels are appropriately coupled. Applicant acknowledges that the use of the LMS algorithm for adapting FIR filters and/or *single-channel* all-pass filters is both well-known and straightforward. Applicant strongly asserts, however, that it would *not* have been obvious to a person of ordinary skill in the art to apply the LMS algorithm to the adaptation of *<u>two-port</u> all-pass filters*. It is *not* known to adapt *<u>two-port</u> all-pass filters* using the LMS algorithm. Furthermore, <u>the adaptation equations for FIR filters and/or *single-channel* all-pass filters do *not* apply to the adaptation of *two-port all-pass filters*</u>. Thus, a person of ordinary skill in the art would not recognize how to adapt *<u>two-port</u> all-pass filters* using the LMS algorithm.

In further support of Applicant's position that it would *not* have been obvious to a person of ordinary skill in the art to apply the LMS algorithm to the adaptation of *<u>two-port</u> all-pass filters*, Applicant notes that, for most applications, a two-port all-pass filter is *not* advantageous and an FIR filter is much easier to implement. Thus, persons of ordinary skill in the art are inclined to use FIR filters and, due to the complexity of an implementation with *<u>two-port</u> all-pass filters*, would *not* be motivated to substitute a two-port all-pass filter for a FIR filter,

in the manner suggested by the Examiner. In addition, since the adaptation equations for FIR filters and/or *single-channel* all-pass filters do *not* apply to the adaptation of *two-port all-pass filters*, the combination suggested by the Examiner would not work.

Similarly, Applicant notes that independent claims 7 and 18 require adjusting coefficients of said two-port all-pass filters using a Newton algorithm. Support for this amendment can be found, for example, in FIGS. 5 and 6 and associated text wherein the cross-coupled box T, as defined in equation (1), defines a two-port network since the two channels are appropriately coupled. Applicant acknowledges that the use of the Newton algorithm for adapting FIR filters and/or *single-channel* all-pass filters is both well-known and straightforward. Applicant strongly asserts, however, that it would *not* have been obvious to a person of ordinary skill in the art to apply the Newton algorithm to the adaptation of *two-port all-pass filters*. It is *not* known to adapt *two-port all-pass filters* using the Newton algorithm. Furthermore, the adaptation equations for FIR filters and/or *single-channel* all-pass filters do *not* apply to the adaptation of *two-port all-pass filters*. Thus, a person of ordinary skill in the art would not recognize how to adapt *two-port all-pass filters* using the Newton algorithm.

In further support of Applicant's position that it would *not* have been obvious to a person of ordinary skill in the art to apply the Newton algorithm to the adaptation of *two-port all-pass filters*, Applicant notes that for most applications, a two-port all-pass filter is *not* advantageous and an FIR filter is much easier to implement. Thus, persons of ordinary skill in the art are inclined to use FIR filters and due to the complexity of an implementation with *two-port all-pass filters*, would *not* be motivated to substitute a *two-port all-pass filter* for an FIR filter, in the manner suggested by the Examiner. In addition, since the adaptation equations for FIR filters and/or *single-channel* all-pass filters do *not* apply to the adaptation of *two-port all-pass filters*, the combination suggested by the Examiner would *not* work.

In the Examiner's Answer, the Examiner asserted that McFarlane teaches polarization dispersion compensation because McFarlane teaches compensating signal irregularities including polarization.

Contrary to the Examiner's assertion, while MacFarlane et al. may address optical filtering and polarization, there is no disclosure or suggestion to *compensate for polarization mode dispersion*. The term "polarization mode dispersion" does not even seem to appear in MacFarlane et al.

The Examiner also reiterates that Eyal teaches adjusting coefficients using a Newton algorithm since Eyal teaches "using a Newton algorithm to optimize variables in equations for producing optimized filter coefficients."

Contrary to the Examiner's assertion, Eyal does **not** teach that filter coefficients are adjusted using a Newton algorithm in the discussion on page 1089, end of first par. of right column. While the Newton algorithm is discussed in this passage, it is **not** in connection with the adjustment of filter coefficients. Rather, the discussion at page 1089, end of first par. of right column, is directed to correction of *optimization variables*. The *optimization variables* are clearly distinct from the coefficients in the preceding discussion in the same paragraph.

Applicant has already acknowledged that the use of the Newton algorithm for adapting FIR filters is both well-known and straightforward. As noted above, Applicant strongly asserts, however, that it would not have been obvious to a person of ordinary skill in the art to apply the Newton algorithm to the adaptation of two-port all-pass filters. It is not known to adapt two-port all-pass filters using the Newton algorithm. Furthermore, the adaptation equations for FIR filters do not apply to the adaptation of a two-port all-pass filter. Thus, a person of ordinary skill in the art would not recognize how to adapt <u>*two-port*</u> *all-pass filters* using the Newton algorithm.

Also, contrary to the Examiner's assertion, while MacFarlane et al. may address optical filtering and polarization, there is no disclosure or suggestion to *compensate for polarization mode dispersion*. The term "polarization mode dispersion" does not even seem to appear in MacFarlane et al.

Thus, MacFarlane et al. does not disclose or suggest the step of "reducing said polarization mode dispersion." In addition, MacFarlane et al. does not disclose or suggest that the polarization mode dispersion is reduced "using a cascade of two-port all-pass filters," and the Examiner has not alleged that MacFarlane et al. discusses all-pass filters.

In addition, again contrary to the Examiner's assertion, MacFarlane et al. does **not** teach that the filter coefficients can be adjusted using a variety of minimization algorithms including an LMS algorithm (citing col. 19, lines 16-22). *While the LMS algorithm is discussed at col. 19, lines 16-22, it is **not** in connection with the adjustment of filter coefficients*. Rather, the discussion at col. 19, lines 16-22 is directed to adjusting "the gains on an on-going basis (of a network traffic router) to minimize error correction coding related error rates" (lines 11-13). It is

further noted that as "the gains are adjusted, the control signal values in the look-up tables are also preferably updated as well." *Id.* at lines 14-16. Applicant can find ***no*** disclosure or suggestion in MacFarlane et al. to adjust the ***coefficients of a filter*** (especially a two-port all-pass filter) using the LMS algorithm (and especially in the context of reducing polarization mode dispersion).

Applicant has previously acknowledged that the use of the LMS algorithm for adapting FIR filters is both well-known and straightforward. As noted above, Applicant strongly asserts, however, that it would not have been obvious to a person of ordinary skill in the art to apply the LMS algorithm to the adaptation of two-port all-pass filters. It is not known to adapt two-port all-pass filters using the LMS algorithm. Furthermore, the adaptation equations for FIR filters do not apply to the adaptation of a two-port all-pass filter. Thus, a person of ordinary skill in the art would not recognize how to adapt *two-port all-pass filters* using the LMS algorithm.

An Examiner must establish "an apparent reason to combine … known elements." *KSR International Co. v. Teleflex Inc. (KSR)*, 550 U.S. ___, 82 USPQ2d 1385 (2007). Here, the Examiner states that it would have been obvious to implement the LMS adaptation of MacFarlane et al. in the system of Madsen as an "engineering design choice" of another way to provide the minimization function. As discussed hereinafter, the use of the LMS algorithm in the manner suggested only by the present invention is more than a mere design choice. Again, any discussion of adaptation using the LMS algorithm is not in the context of adjusting the ***coefficients of a filter*** (especially a two-port all-pass filter in the context of reducing polarization mode dispersion).

Applicant is claiming a new technique for compensating for polarization mode dispersion in an optical fiber communication system *by* using a cascade of two-port all-pass filters; and adjusting coefficients of said two-port all-pass filters *using a least mean square algorithm.*

There is no suggestion in Madsen or in MacFarlane et al., alone or in combination, to adjust coefficients of a cascade of two-port all-pass filters *using a least mean square algorithm.*

In further support of Applicant's position that it would not have been obvious to a person of ordinary skill in the art to apply the LMS algorithm to the adaptation of two-port all-pass filters, Applicant notes that for most applications, an all-pass filter is not advantageous and

an FIR filter is much easier to implement. Thus, persons of ordinary skill in the art are inclined to use FIR filters and due to the complexity of an implementation with a two-port all-pass filter, would not be motivated to substitute a two-port all-pass filter for an FIR filter, in the manner suggested by the Examiner. In addition, since the adaptation equations for FIR filters do not apply to the adaptation of a two-port all-pass filter, the combination suggested by the Examiner *would not work.*

The above-noted complexity of an implementation with a two-port all-pass filter also strongly contradicts the Examiner's contention that the combination is motivated by a desire to "quickly and accurately compensate (for) dispersion." In addition, this strong inclination by those of ordinary skill towards the use of FIR filters makes the proposed combination more than a mere "substitution" of one minimization algorithm for another.

This information known to those of ordinary skill in the art ***teaches away*** from the present invention. The *KSR* Court discussed in some detail United States v. Adams, 383 U.S. 39 (1966), stating in part that in that case, "[t]he Court relied upon the corollary principle that when the prior art teaches away from combining certain known elements, discovery of a successful means of combining them is more likely to be nonobvious." (KSR Opinion at p. 12). Thus, there is no reason to make the asserted combination/modification.

In the Response to Arguments section of the Office Action, the Examiner asserted that it would have been obvious to a person of ordinary skill in the art to substitute one minimization algorithm for another in optimizing the all-pass filters disclosed by Madsen to achieve a predictable result of optimizing the filter coefficient values.

In the Response to Arguments section of the Office Action, the Examiner notes, in regard to Applicant's argument that "the adaptation equations for FIR filters do not apply to the adaptation of an all-pass filter," that the rejected claims do not recite particular equations.

Applicant notes that the cited argument was presented to illustrate that the Examiner's proposed combination of references was *not* valid because the combination suggested by the Examiner *would not work.* Applicant's argument is valid regardless of whether the equations are recited in the claims.

Claims 7 and 18

Independent claims 7 and 18 were rejected under 35 U.S.C. §103(a) as being unpatentable over Madsen in view of Eyal et al. With regards to claims 7 and 18, the Examiner

again asserts that Madsen discloses a method for compensating for polarization mode dispersion in an optical fiber communication system (citing Figures 1-3), comprising the steps of: reducing said polarization mode dispersion using a cascade of all-pass filters (citing Abstract and Fig. 3); and adjusting coefficients of said all-pass filters. (citing page 535, left column, first complete paragraph).

The Examiner acknowledges that Madsen adjusts the coefficients using a least square algorithm (citing page 535, left column, first complete par.), but does **not** disclose adjusting the coefficients using a *Newton algorithm*. The Examiner asserts, however, that various optimization algorithms are known and that Eyal et al. teach in a system including optical filters for compensating for polarization mode dispersion having adjusted coefficients (page 1088) Eyal et al. further teach that the filter coefficients are adjusted using a Newton algorithm (citing page 1089, end of first par. of right column).

Eyal et al. does not disclose or suggest that the polarization mode dispersion is reduced "using a cascade of two-port all-pass filters," and the Examiner has not alleged that Eyal et al. discusses all-pass filters.

In addition, contrary to the Examiner's assertion, Eyal et al. does **not** teach that filter coefficients are adjusted using a Newton algorithm in the discussion on page 1089, end of first par. of right column. While the Newton algorithm is discussed in this passage, it is **not** in connection with the adjustment of filter coefficients. Rather, the discussion at page 1089, end of first par. of right column, is directed to correction of *optimization variables*. The *optimization variables* are clearly distinct from the coefficients in the preceding discussion in the same paragraph.

Applicant has already acknowledged that the use of the Newton algorithm for adapting FIR filters is both well-known and straightforward. As noted above, Applicant strongly asserts, however, that it would not have been obvious to a person of ordinary skill in the art to apply the Newton algorithm to the adaptation of two-port all-pass filters. It is not known to adapt two-port all-pass filters using the Newton algorithm. Furthermore, the adaptation equations for FIR filters do not apply to the adaptation of a two-port all-pass filter. Thus, a person of ordinary skill in the art would not recognize how to adapt <u>*two-port*</u> *all-pass filters* using the Newton algorithm.

An Examiner must establish "an apparent reason to combine ... known elements." *KSR International Co. v. Teleflex Inc. (KSR)*, 550 U.S. ___, 82 USPQ2d 1385 (2007). Here, the Examiner merely states that it would have been obvious to implement the Newton adaptation of Eyal et al. in the system of Madsen as an "engineering design choice" of another way to provide the minimization function. As discussed hereinafter, the use of the Newton algorithm in the manner suggested only by the present invention is more than a mere design choice.

Applicant is claiming a new technique for compensating for polarization mode dispersion in an optical fiber communication system *by* using a cascade of two-port all-pass filters; and adjusting coefficients of said two-port all-pass filters *using a Newton algorithm.*

There is no suggestion in Madsen or in Eyal et al., alone or in combination, to adjust coefficients of a cascade of two-port all-pass filters *using a Newton algorithm.*

In further support of Applicant's position that it would not have been obvious to a person of ordinary skill in the art to apply the Newton algorithm to the adaptation of two-port all-pass filters, Applicant notes that for most applications, an all-pass filter is not advantageous and an FIR filter is much easier to implement. Thus, persons of ordinary skill in the art are inclined to use FIR filters and due to the complexity of an implementation with a two-port all-pass filter, would not be motivated to substitute a two-port all-pass filter for an FIR filter, in the manner suggested by the Examiner. In addition, since the adaptation equations for FIR filters do not apply to the adaptation of a two-port all-pass filter, the combination suggested by the Examiner would not work.

The above-noted complexity of an implementation with a two-port all-pass filter also strongly contradicts the Examiner's contention that the combination is motivated by a desire to "quickly and accurately compensate (for) dispersion." In addition, this strong inclination by those of ordinary skill towards the use of FIR filters makes the proposed combination more than a mere "substitution" of one minimization algorithm for another.

This information known to those of ordinary skill in the art ***teaches away*** from the present invention. The *KSR* Court discussed in some detail United States v. Adams, 383 U.S. 39 (1966), stating in part that in that case, "[t]he Court relied upon the corollary principle that when the prior art teaches away from combining certain known elements, discovery of a successful means of combining them is more likely to be nonobvious." (KSR Opinion at p. 12). Thus, there is no reason to make the asserted combination/modification.

Applicant respectfully requests the withdrawal of the rejection of independent claims 1, 7, 13 and 18.

Dependent Claims

Claims 2-6, 8-12, 14-17 and 19-22 are dependent on independent claims 1, 7, 13 and 18, and are therefore patentably distinguished over Madsen, MacFarlane et al., Eyal et al. and Wang et al., alone or in any combination, because of their dependency from amended independent claims 1, 7, 13 and 18 for the reasons set forth above, as well as other elements these claims add in combination to their base claim.

The Examiner has already indicated that claims 6 and 12 would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Conclusion

All of the pending claims following entry of the amendments, i.e., claims 1-22, are in condition for allowance and such favorable action is earnestly solicited.

If any outstanding issues remain, or if the Examiner or the Appeal Board has any further suggestions for expediting allowance of this application, the Examiner and the Appeal Board are invited to contact the undersigned at the telephone number indicated below.

The attention of the Examiner to this matter is appreciated.

Respectfully submitted,

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